299-E28-1 (A6784)

Log Data Report

Borehole Information:

Borehole: 299-E28-1 (A6784)			**Site:** 216-B-59 Trench		
Coordinates (WA State Plane)		**GWL (ft)[1]:** 287.1		**GWL Date:**	06/04/2002
North	**East**	**Drill Date**	**TOC[2] Elevation**	**Total Depth (ft)**	**Type**
136,733 m	573,934 m	Nov. 1947	209.85 m	325	Cable Tool

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Welded steel	2.8	8.625	8	0.3125	2.8	324
Screen	N/A[3]	8			273	322

Borehole Notes:

The logging engineer measured the casing using a steel tape. A reference point survey "X" is not located on the casing. Top of casing stickup is cut squarely. HWIS[4] is the source of the TOC elevation, and the *Hanford Site Atlas* (BHI 1998) is the source of the coordinates. Drill date, total depth, and casing bottom are from information provided in Ledgerwood (1993), which reports a ground level reference. This borehole was not swabbed prior to logging.

Logging Equipment Information:

Logging System:	Gamma 1D		**Type:** SGLS (35%)
Calibration Date:	7/01/01	**Calibration Reference:**	GJO-2002-243-TAR
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3	4	5
Date	06/03/02	06/04/02	06/06/02	06/10/02	06/11/02
Logging Engineer	Spatz	Spatz	Spatz	Spatz	Spatz
Start Depth (ft)	3.0	323.0	113.5	189.0	268.0
Finish Depth (ft)	65.0	278.5	64.0	112.5	188.0
Count Time (sec)	100	100	100	100	100
Live/Real	R	R	R	R	R
Shield (Y/N)	N/A	N/A	N/A	N/A	N/A
MSA Interval (ft)	0.5	0.5	0.5	0.5	0.5
ft/min	N/A	N/A	N/A	N/A	N/A
Pre-Verification	AD006CAB	AD008CAB	AD009CAB	AD010CAB	AD011CAB
Start File	AD007000	AD008000	AD009000	AD010000	AD011000
Finish File	AD007124	AD008089	AD009099	AD010153	AD011160
Post-Verification	AD007CAA	None	AD009CAA	AD010CAA	AD011CAA
Depth Return Error (in.)	0	-2	-0.5	-0.5	N/A

Log Run	1	2	3	4	5
Comments	Fine-gain adjustment and post verification note below. Data questionable.	Fine-gain adjustment and post verification note below. Data unusable.	No fine-gain adjustment made. Data unusable.	Fine-gain adjustment note below.	No fine-gain adjustment.

Log Run	6	7	8	9	10
Date	06/11/02	06/12/02	06/12/02	06/13/02	06/13/02
Logging Engineer	Spatz	Spatz	Spatz	Spatz	Spatz
Start Depth (ft)	120.0	323.0	99.0	3.0	96.0
Finish Depth (ft)	100.0	267.0	64.0	65.0	103.0
Count Time (sec)	100	100	100	100	100
Live/Real	R	R	R	R	R
Shield (Y/N)	N/A	N/A	N/A	N/A	N/A
MSA Interval (ft)	0.5	0.5	0.5	0.5	0.5
ft/min	N/A	N/A	N/A	N/A	N/A
Pre-Verification	AD011CAB	AD012CAB	AD012CAB	AD014CAB	AD014CAB
Start File	AD011161	AD012000	AD013000	AD014000	AD014125
Finish File	AD011201	AD012112	AD013070	AD014124	AD014139
Post-Verification	AD011CAA	AD013CAA	AD013CAA	AD014CAA	AD014CAA
Depth Return Error (in.)	-0.5	-1	0	N/A	-0.5
Comments	Re-log section. No fine-gain adjustment.	Repeat and re-log section. No fine-gain adjustment.	Re-log section. Adjusted fine-gain before log run. During log run no fine-gain adjustment.	Re-log section. No fine-gain adjustment.	Re-log section. No fine-gain adjustment.

Logging Operation Notes:

Zero reference for the SGLS logging is the top of casing. A centralizer was installed on the sonde except for data collected on 06/04/02 and on 06/12/02 from 323.0 to 267.0 ft. Pre- and post-survey verification measurements for the SGLS employed the Amersham KUT verifier with SN 118.

During logging run 1, 06/03/02, a fine-gain adjustment was made after file AD007084, and post-survey spectrum AD007CAA failed verification criteria.

On 06/04/02, the pre-survey spectrum passed verification criteria, and logging was resumed. Fine-gain adjustments were made after files AD008002, -019, -036, -050, and -054. Logging terminated after file -089. A post-logging spectrum was not collected. Data collected during logging run 2 were unusable; this interval was relogged.

On 06/05/02, the SGLS Gamma 1D logging system was inspected. One cable wire was shorted and one cable head connection was broken. Repairs were made and logging resumed on 06/06/02. The post-survey spectrum (AD009CAA) failed verification criteria after logging run 3. This interval was relogged.

On 06/10/02, the log program CASASII was reinstalled, and the pre-survey spectrum passed the verification criteria. A fine-gain adjustment was made after file AD010110.

Analysis Notes:

Analyst:	Sobczyk	Date:	06/18/02	Reference:	MAC-HGLP 1.6.3, Rev. 0

SGLS pre-run and post-run verification spectra were collected at the beginning and end of each day. The pre-run verification spectra were all within the control limits, and the post-run verification spectra were all within the control limits except for spectra AD007CAA, AD009CAA, and AD011CAA. After review of the log spectra and the verification spectra, the SGLS was serviced. After the system was repaired on 06/05/02 and the log program CASASII was reinstalled on 06/10/02, the entire borehole was logged with a fully functioning system.

After the system was repaired, the recorded peak counts per second (cps) at the 609-keV, 1461-keV, and 2615-keV photopeaks on the post-run verification spectra as compared to the pre-run verification spectra for each day were generally within about 8 percent of one another at each spectrum's energy line. On June 11, 2002, the AD011CAA (post-verification) spectrum failed to meet one of the six acceptance criteria. The recorded peak counts per second at the 2615-keV photopeak on the post-run verification spectrum was less than 90 % of the peak counts per second on the pre-run; however, the post-run verification spectrum was within the control limits established for the pre-run verification spectra. Examinations of spectra indicate that the SGLS appears to have functioned normally during these log runs (5 and 6), and the log data are provisionally accepted. The data from log runs 1, 2, and 3 are excluded from further processing and are not included on the log plots.

Log spectra for the SGLS were processed in batch mode using APTEC Supervisor to identify individual energy peaks and determine count rates. For most of the log spectra, the pre-verification spectra were used to determine the energy and resolution calibration for processing the data using APTEC Supervisor. Concentrations were calculated in EXCEL (source file: G1DJul1.xls), using parameters determined from analysis of recent calibration data. Zero reference is the top of the casing. The casing configuration (Ledgerwood 1993) was assumed to be one string of 8-in. casing with a thickness of 0.322 in. to the maximum depth of the log and a telescoping screen with a thickness of 0.1 in. from 275.8 ft to the maximum depth of the log. A casing thickness of 0.322 in. is the published value for ASTM schedule-40 steel pipe (a commonly used casing material at Hanford) and is within the range of measurement error associated with the logging engineer's measurements. Information on the screen is limited, and the assumed thickness of the screen is based on screens that are currently used at the Hanford Site. A water correction was applied to the SGLS data below 287.1 ft. Dead time corrections were not needed because dead time did not exceed 10.5 percent.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (^{40}K, ^{238}U, and ^{232}Th), and man-made radionuclides. Data from log runs 1, 2, and 3 are not included on these plots. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing correction. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation.

Results and Interpretations:

^{137}Cs and ^{60}Co were the man-made radionuclides detected in this borehole. ^{137}Cs was detected near the ground surface (3.0- to 4.5-ft log depth) at activities ranging from its MDL (0.2 pCi/g) to 0.7 pCi/g. ^{137}Cs was detected at log depths of 279.0 and 279.5 ft with an activity 0.3 pCi/g and at 275 ft with an activity of 0.2 pCi/g. ^{60}Co was detected at 285 ft near the MDL (about 0.1 pCi/g) and from about 316.5 ft to total depth at concentrations ranging from 0.2 to 1.1 pCi/g.

Recognizable changes in the KUT logs occurred in this borehole. An increase of about 5 pCi/g in apparent ^{40}K activity occurs at approximately 17 ft, and decreases of about 5 pCi/g are evident at approximately 223 and 265 ft. The increase in ^{40}K activities at 17 ft probably represents the transition from the coarse-grained sediments of the Hanford H1 to the finer grained sediments of the Hanford H2. The decrease in ^{40}K activities at 223 ft probably represents the transition to the coarse-grained sediments of the Hanford H3 from the Hanford H2.

The plot of the repeat logs demonstrates reasonable repeatability of the SGLS data for the naturally occurring radionuclides.

The behavior of the total gamma at the overlaps of the log runs suggests that radon is present inside the borehole casing. This effect is observed at 25 and at 65 ft and between 96 and 113 ft. Radon daughters such as ^{214}Bi may also "plate" onto the sonde itself. When this occurs, there is a gradual increase in total counts as well as photopeak counts associated with ^{214}Bi and ^{214}Pb. This phenomenon appears to best explain the observed total gamma at the overlaps. The presence of radon is not an indication of man-made contamination; it is derived from decay of naturally occurring uranium. As a gas, radon moves easily in the subsurface, and concentrations of radon and its associated progeny can change quickly.

The gross gamma profile from Additon et al. (1978) (attached) suggests that gamma-emitting contamination may have been present in the sediments surrounding this borehole at depth. The profile from 5/11/59 may have detected gamma activity above background in the borehole below about 82 m (269 ft).

References:

Additon, M.K., K.R. Fecht, T.L. Jones, and G.V. Last, 1978. *Scintillation Probe Profiles From 200 East Area Crib Monitoring Well*s, RHO-LD-28, Rockwell Hanford Operations, Richland, Washington.

Bechtel Hanford, Inc. (BHI), 1998. *Hanford Site Atlas*, BHI-01119, Rev. 1, Bechtel Hanford, Inc., Richland, Washington.

Ledgerwood, R.K., 1993. *Summaries of Well Construction Data and Field Observations for Existing 200-East Resource Protection Wells*, WHC-SD-ER-TI-007, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

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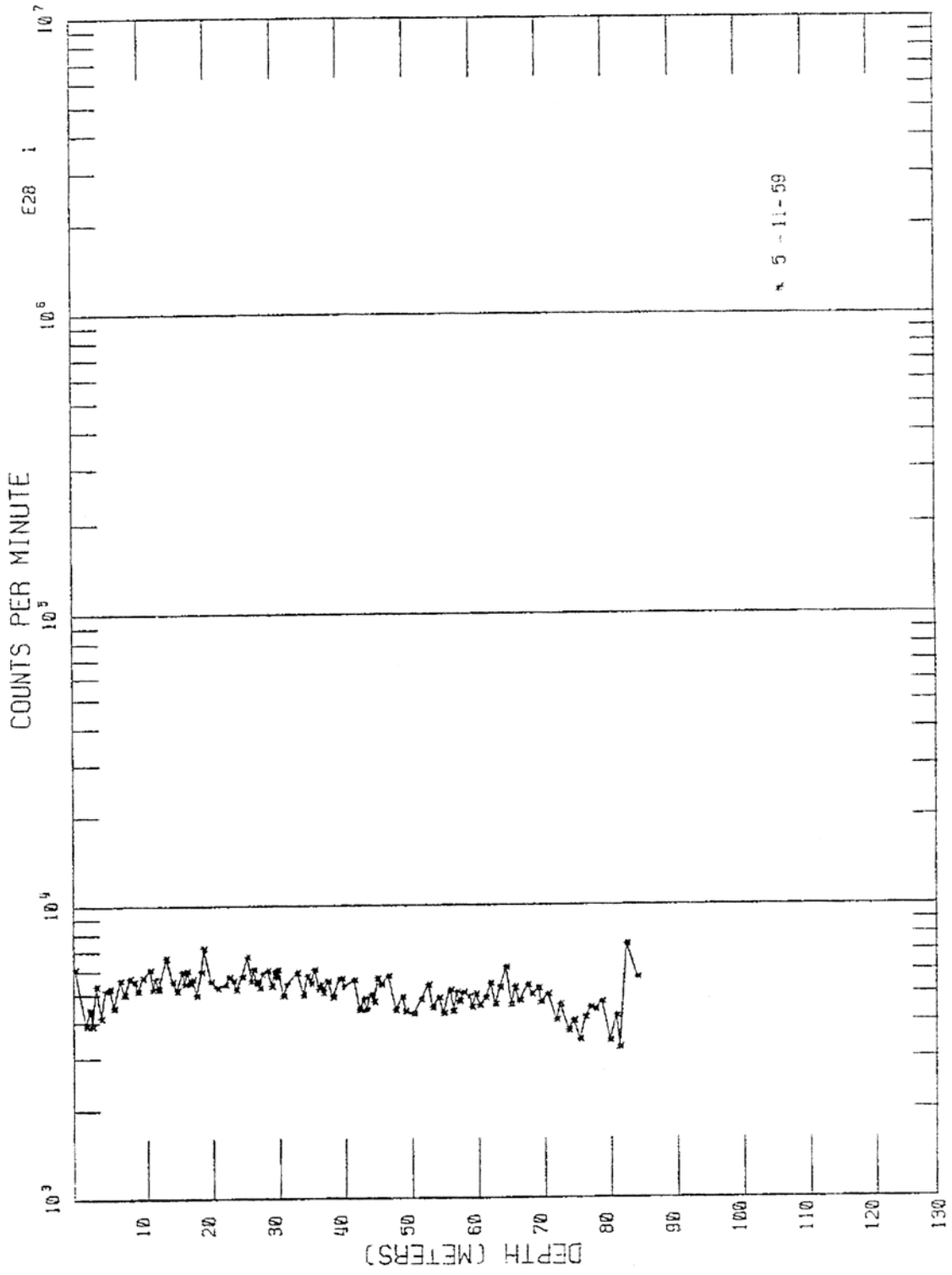
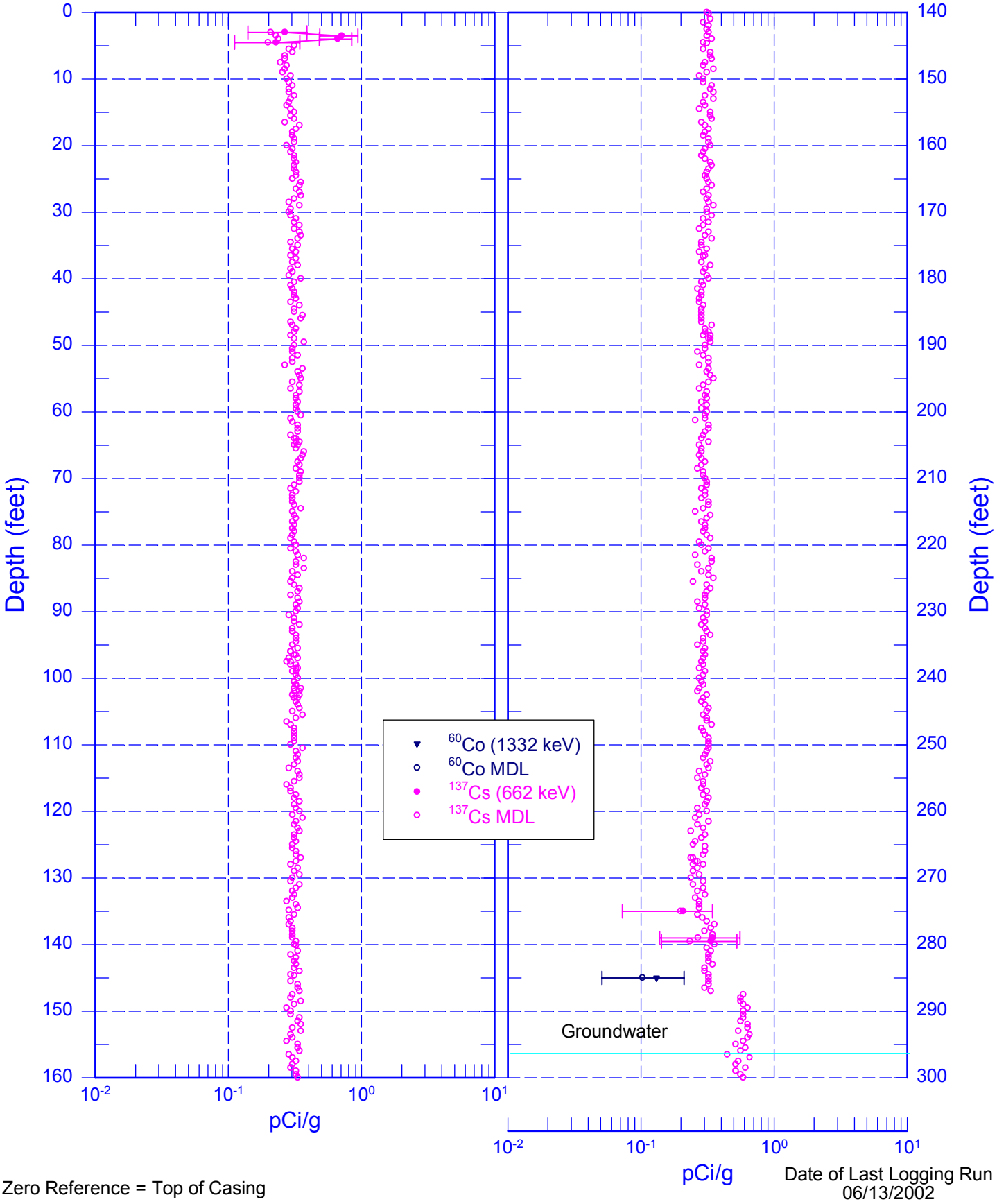
[1] GWL – groundwater level
[2] TOC – top of casing
[3] N/A – not applicable
[4] HWIS – Hanford Well Information System



from Additon et al. (1978)

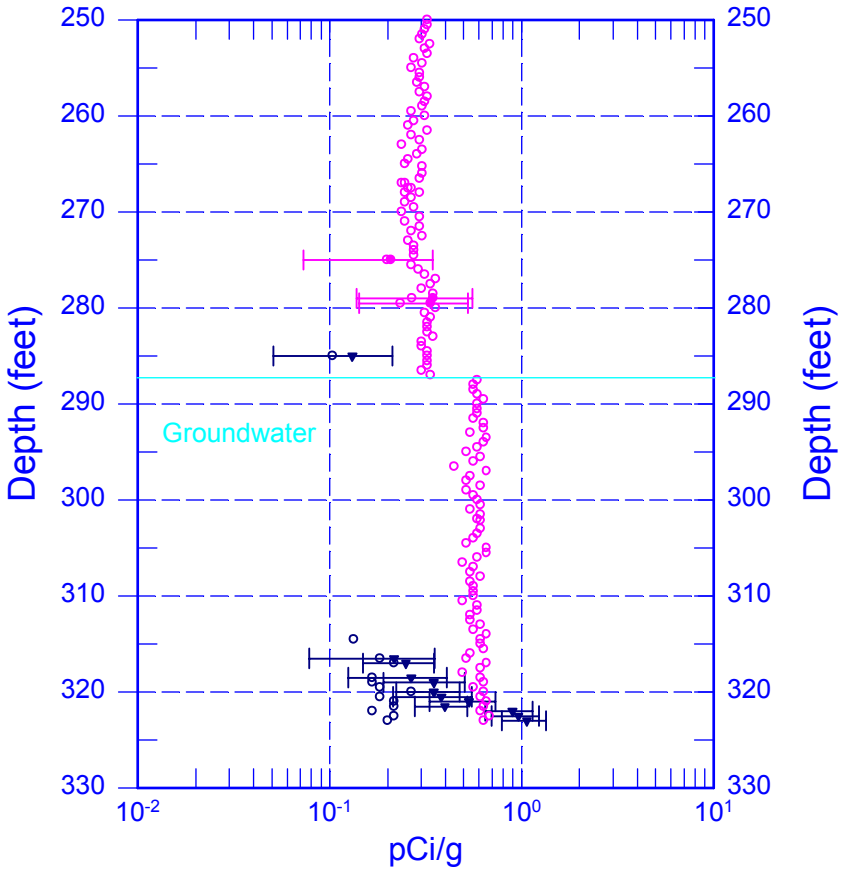
299-E28-1 (A6784)
Man-Made Radionuclides



Zero Reference = Top of Casing

Date of Last Logging Run
06/13/2002

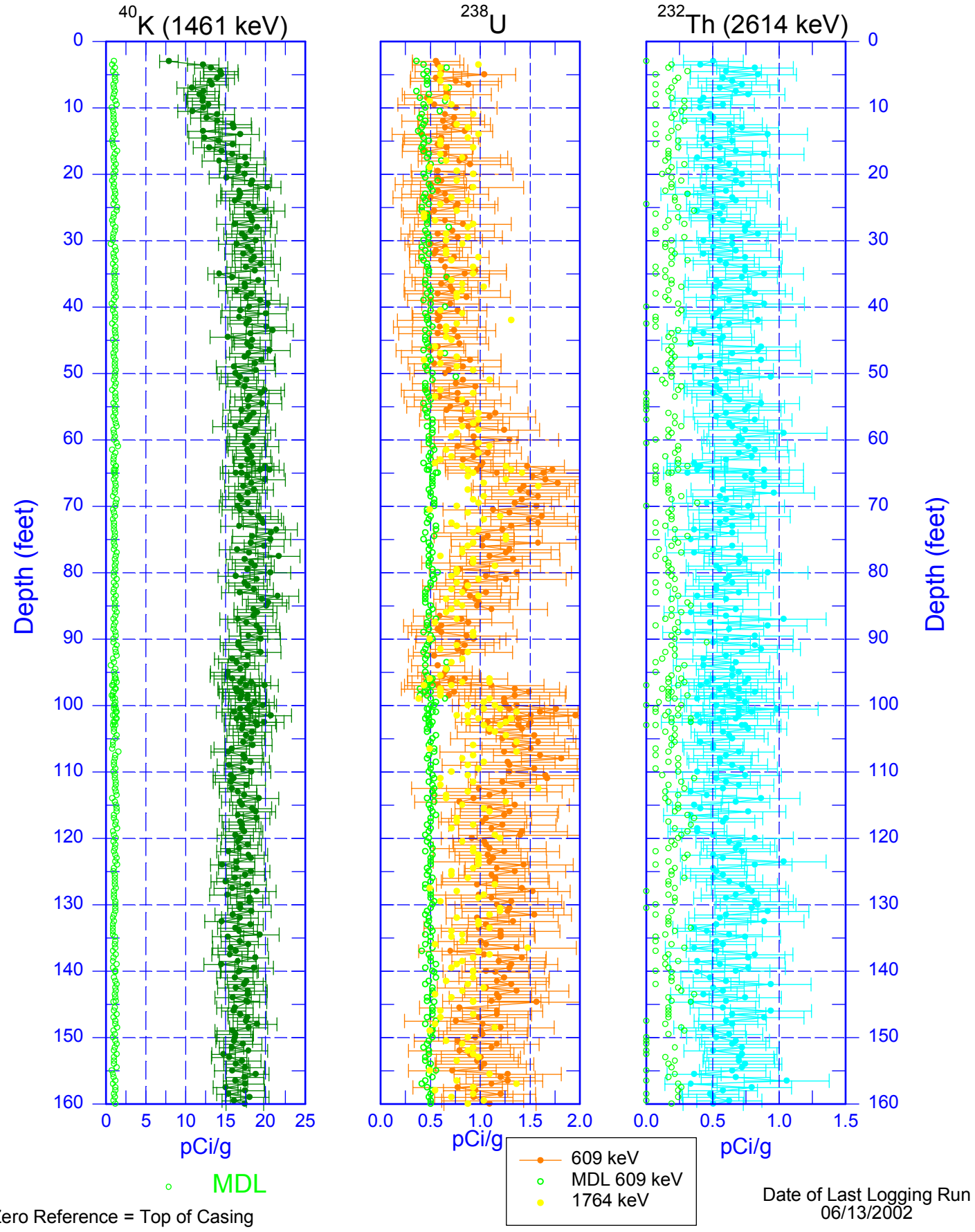
299-E28-1 (A6784)
Man-Made Radionuclides



Zero Reference = Top of Casing

Date of Last Logging Run
06/13/2002

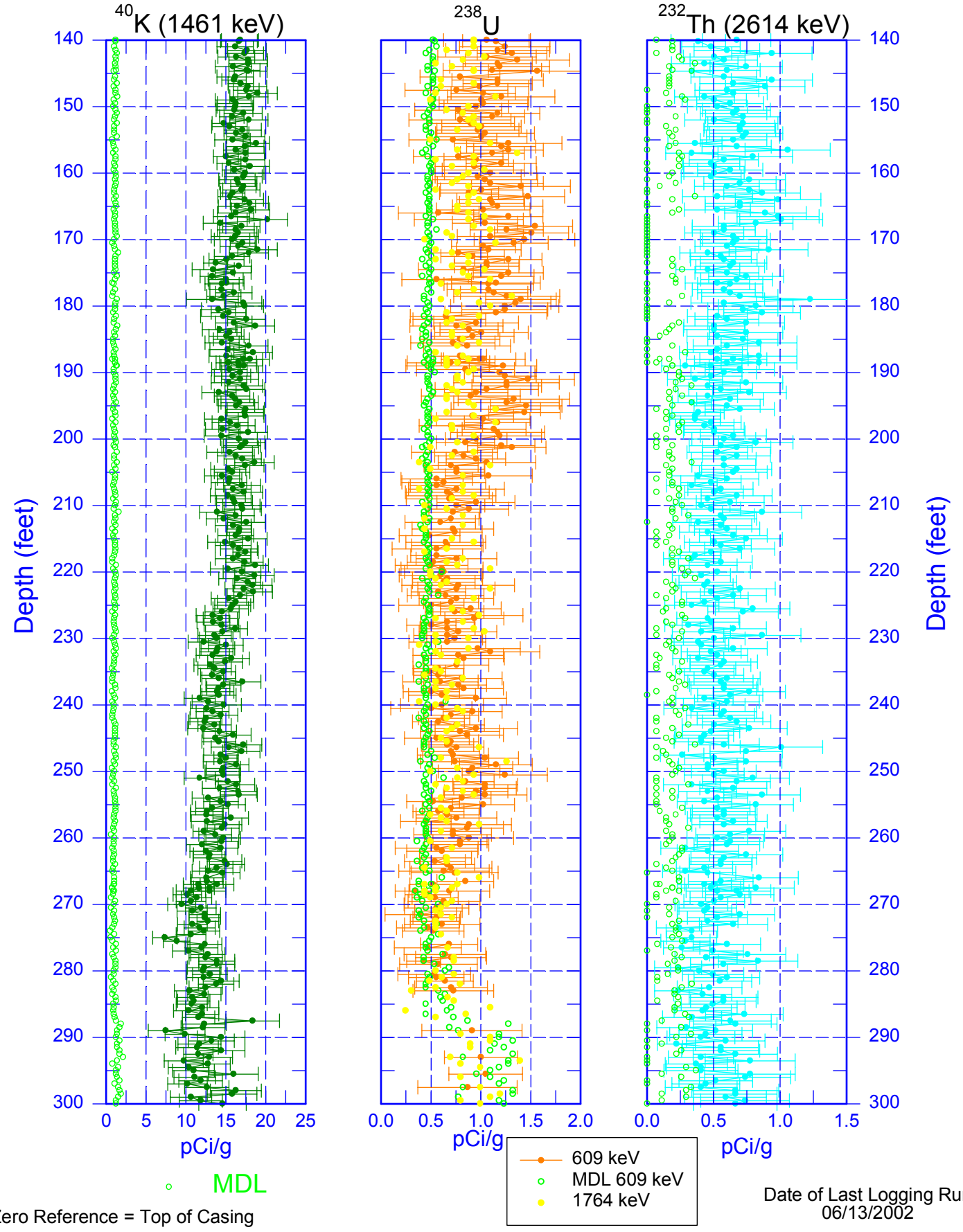
299-E28-1 (A6784)
Natural Gamma Logs



Zero Reference = Top of Casing

Date of Last Logging Run
06/13/2002

299-E28-1 (A6784)
Natural Gamma Logs



Zero Reference = Top of Casing

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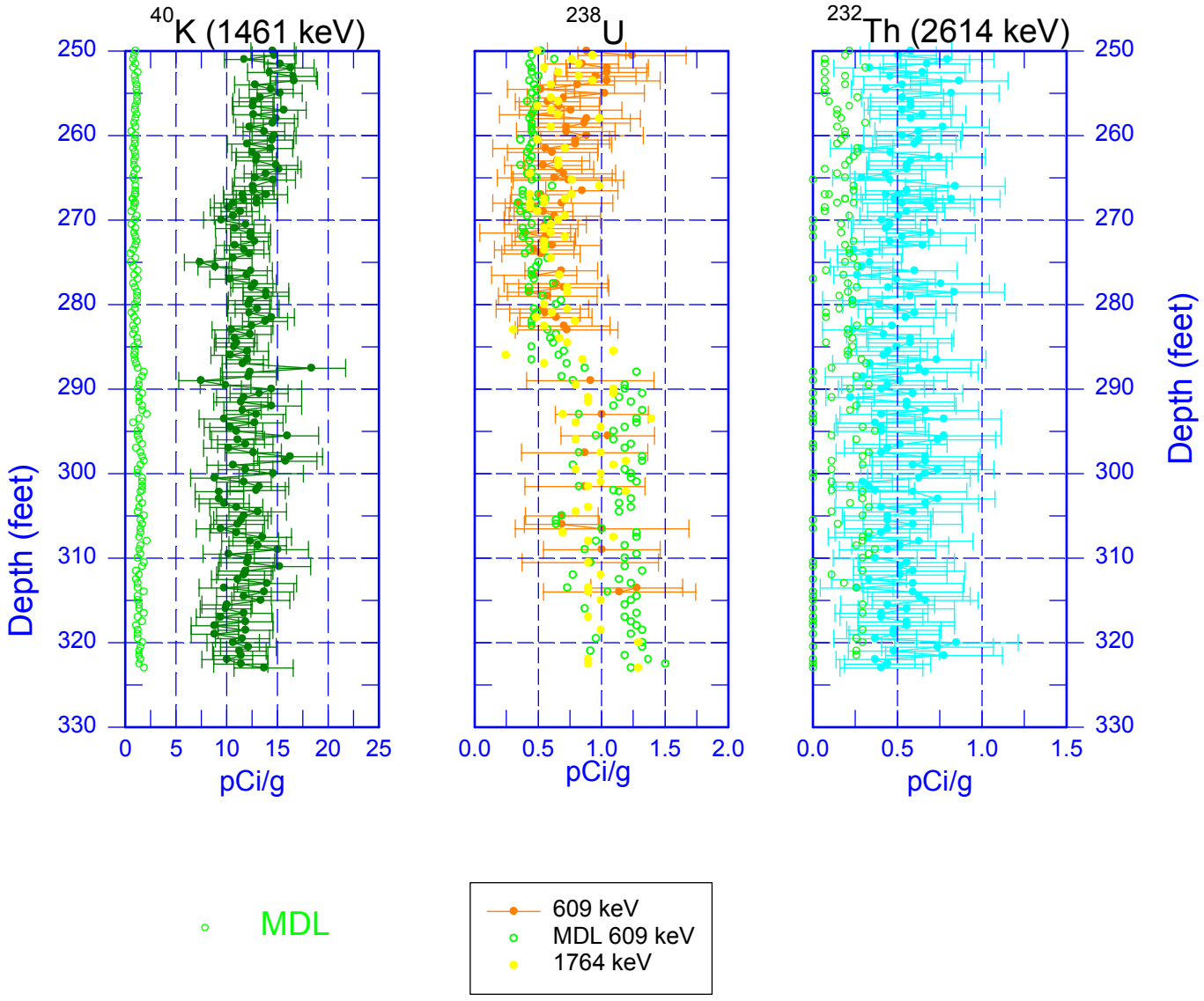
06/13/2002

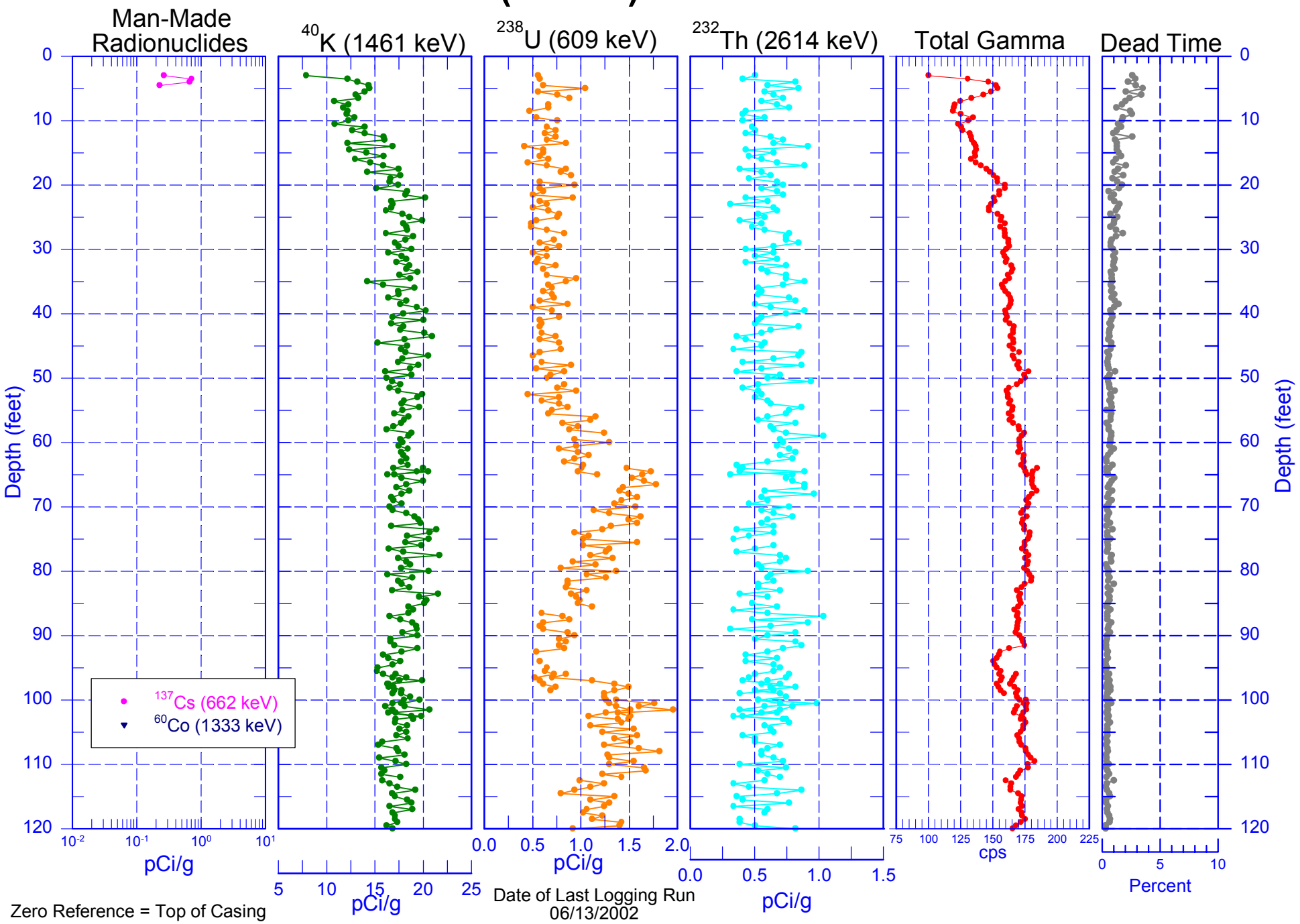
299-E28-1 (A6784)
Natural Gamma Logs



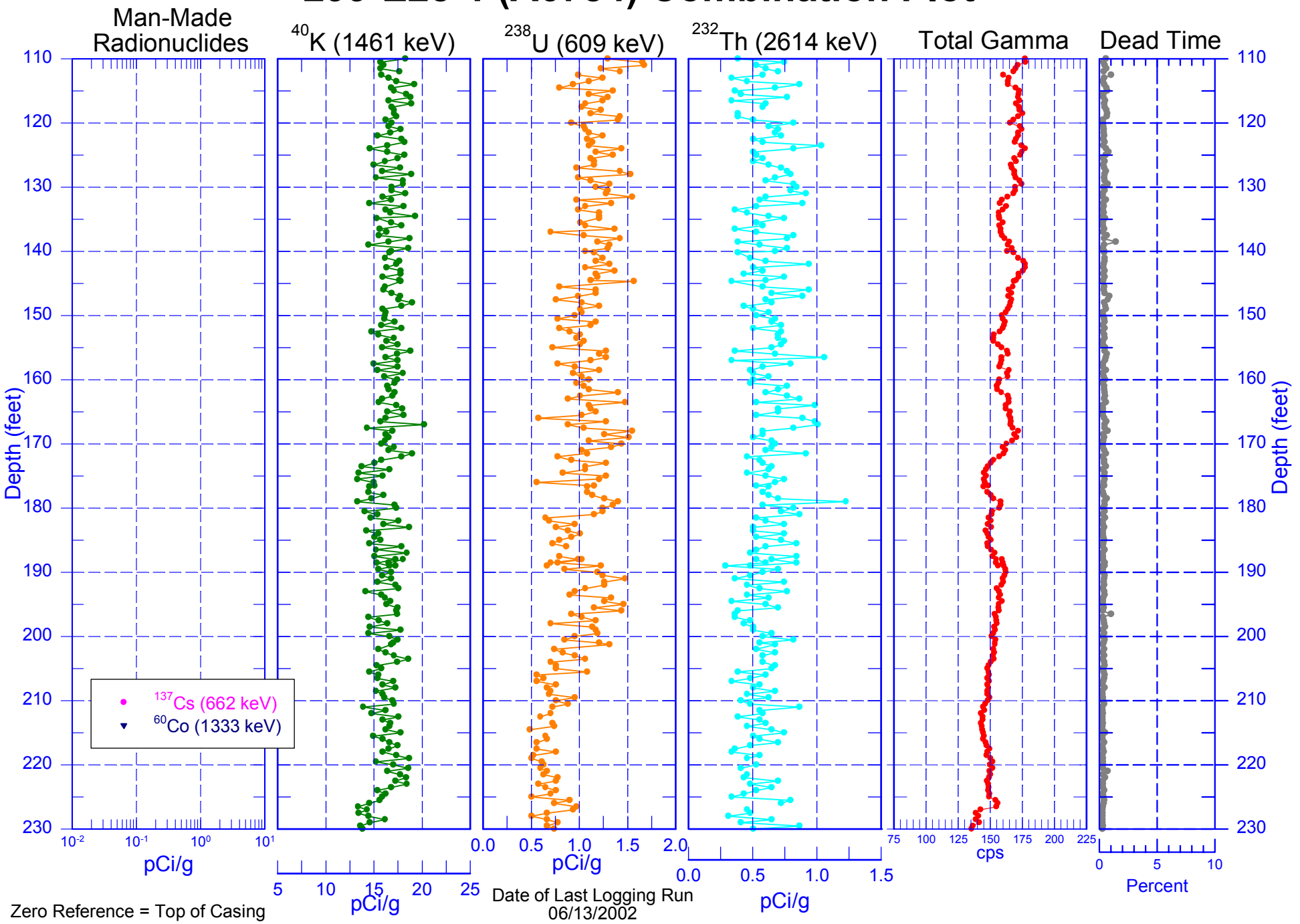
Zero Reference = Top of Casing

Date of Last Logging Run
06/13/2002

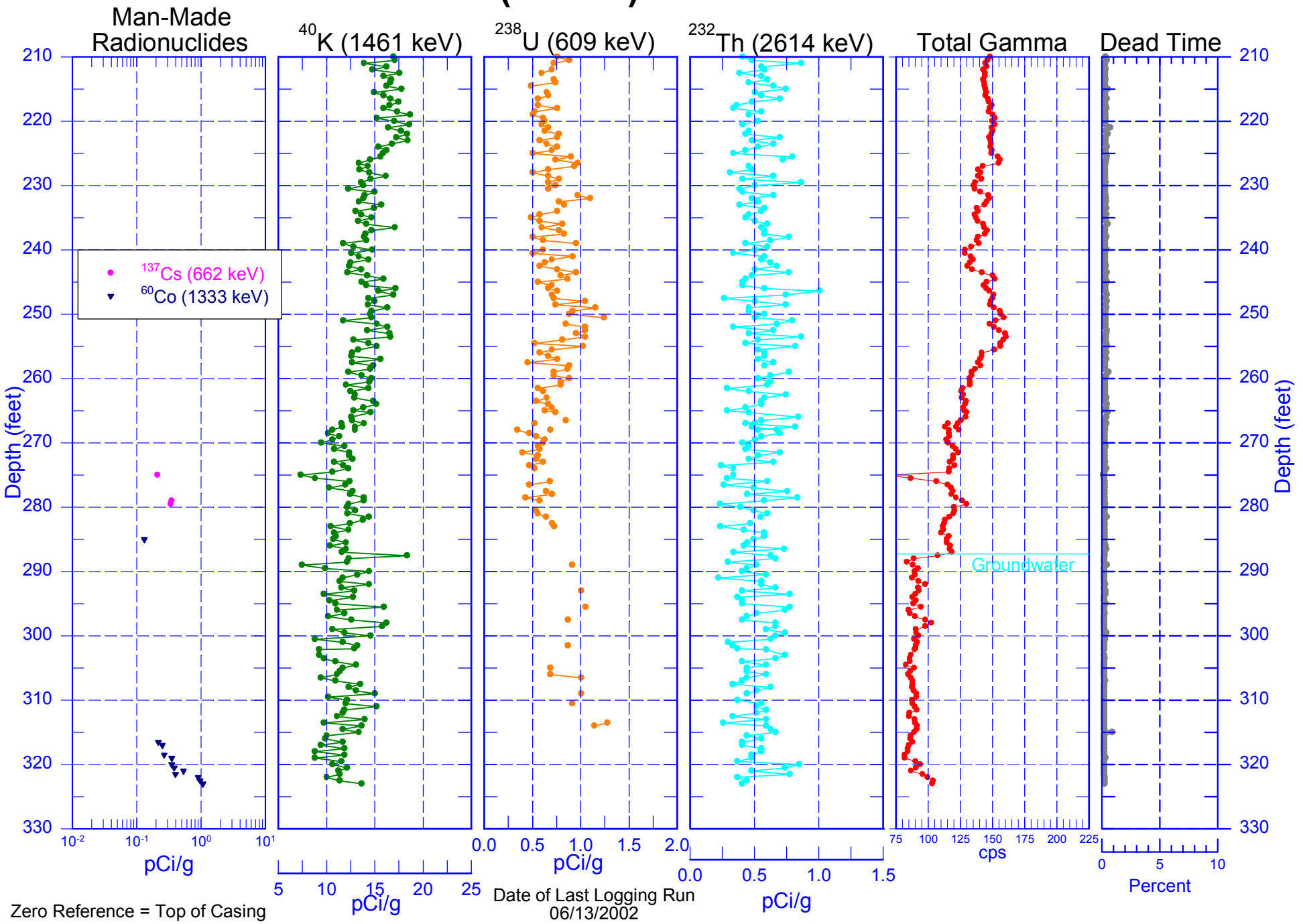
299-E28-1 (A6784) Combination Plot



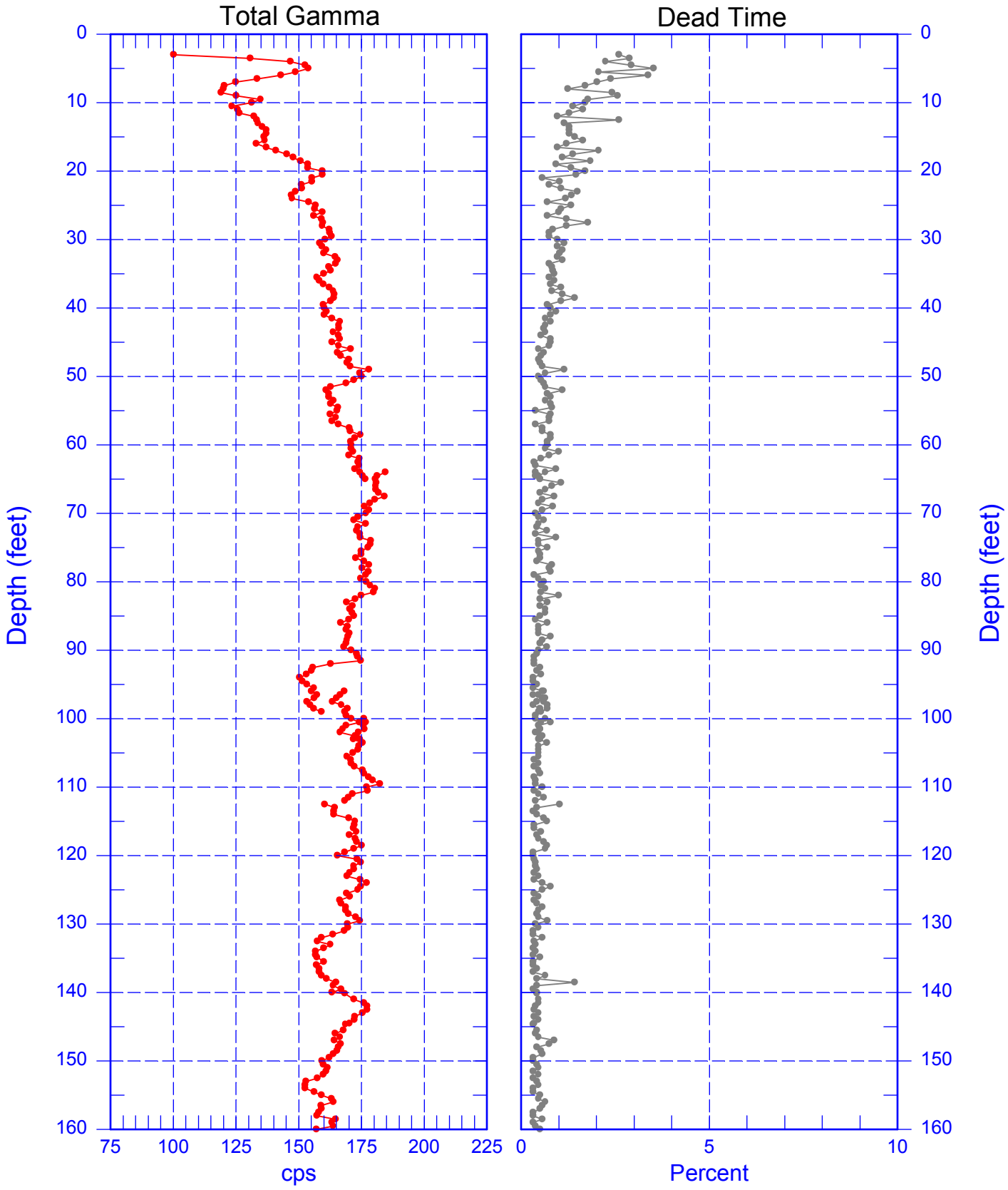
299-E28-1 (A6784) Combination Plot



299-E28-1 (A6784) Combination Plot



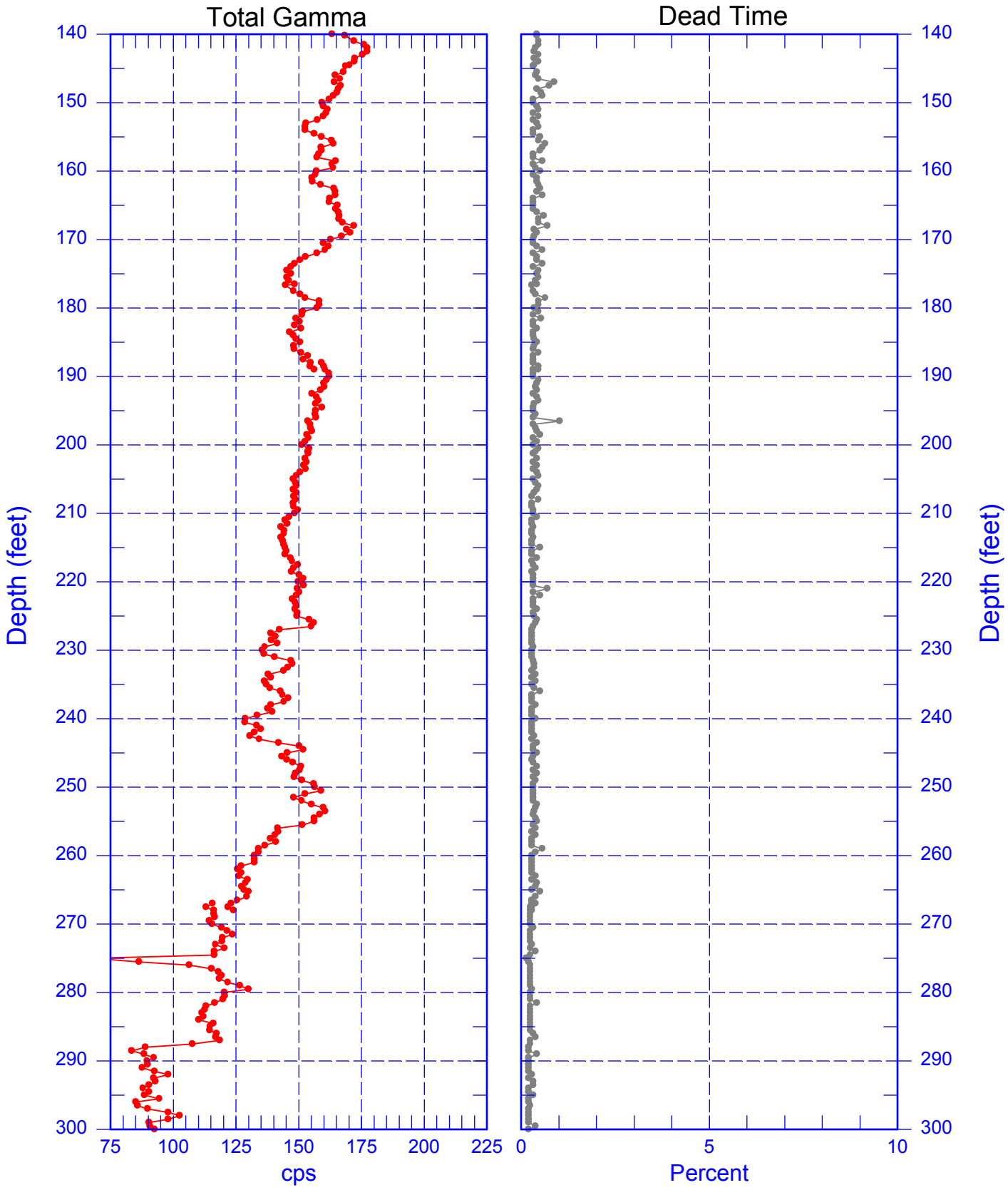
299-E28-1 (A6784)
Total Gamma & Dead Time



Zero Reference = Top of Casing

Date of Last Logging Run
06/13/2002

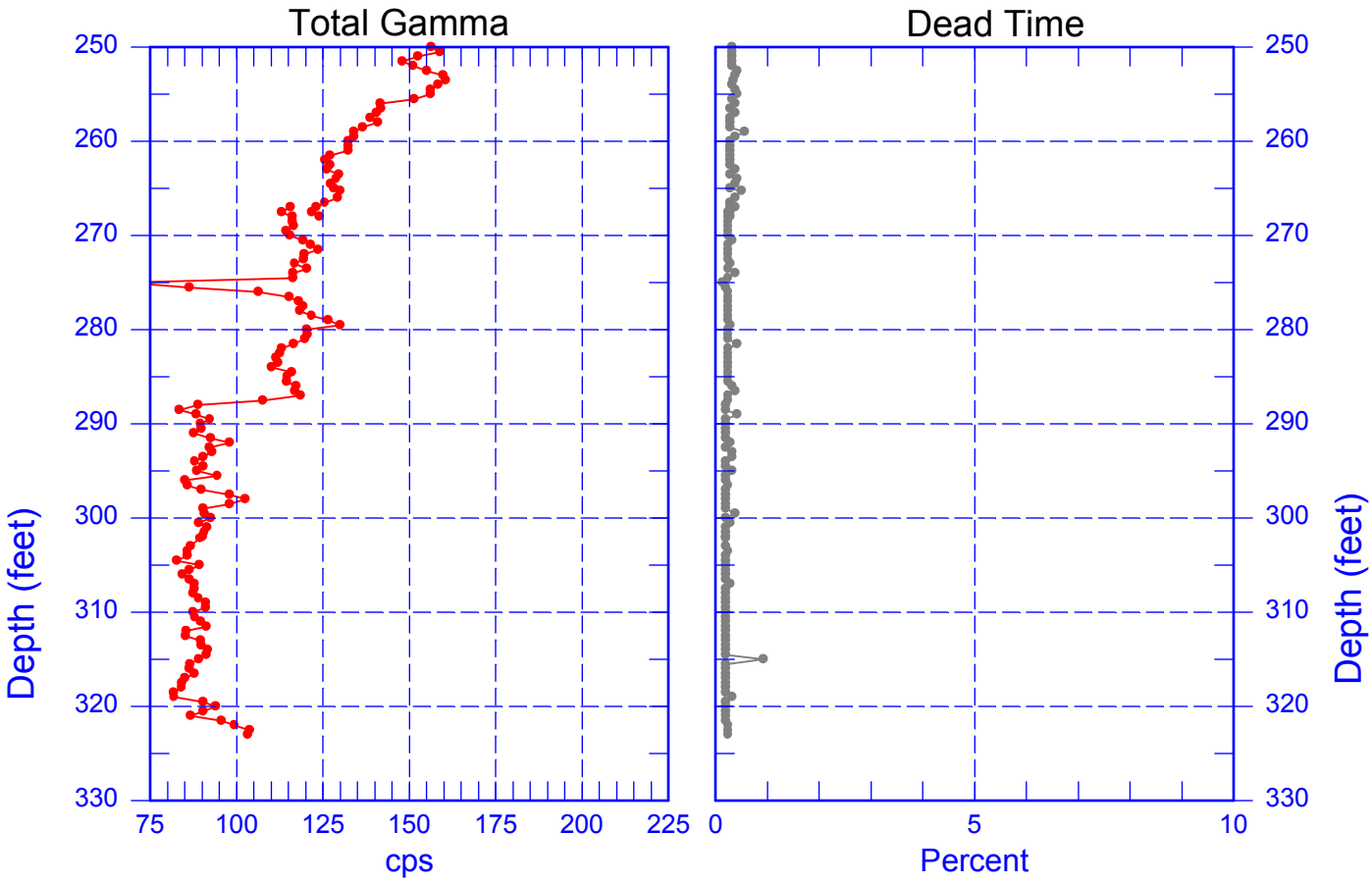
299-E28-1 (A6784)
Total Gamma & Dead Time



Zero Reference = Top of Casing

Date of Last Logging Run
06/13/2002

299-E28-1 (A6784)
Total Gamma & Dead Time



Zero Reference = Top of Casing

Date of Last Logging Run
06/13/2002

299-E28-1 (A6784)

Rerun of Natural Gamma Logs (112.5 to 120.0 ft)